

# (12) UK Patent Application (19) GB (11) 2 288 461 (13) A

(43) Date of A Publication 18.10.1995

(21) Application No 9406842.6

(22) Date of Filing 07.04.1994

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(51) INT CL<sup>6</sup>  
**G01N 33/44 , B29B 17/00 , G01N 21/84**

(52) UK CL (Edition N )  
**G1B BCH  
U1S S1442 S1820**

(56) Documents Cited  
**None**

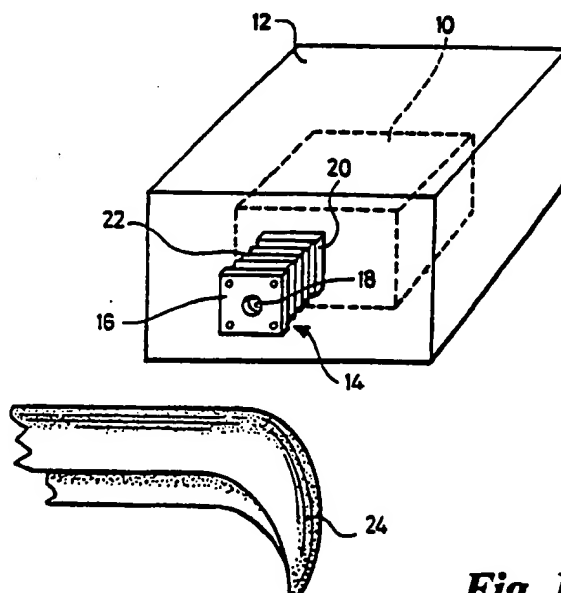
(58) Field of Search  
UK CL (Edition M ) **G1B BAA BCH BCX**  
INT CL<sup>5</sup> **B29B 17/00 , G01N 1/34 21/84**  
**ONLINE DATABASES: WPI, CLAIMS, JAPIO**

## (54) System for plastics identification

(57) To enable a spectrometer (10) to be used for taking analysis readings from plastics articles of varying shapes and degree of preparation, the spectrometer is enclosed within a housing (12) which has an interface device (14) attached to an aperture (18).

The interface has a chamber having a front wall with a sample aperture (18) against which the sample (24) can be placed so that a surface of the sample is exposed to the interior of the chamber, an operable closure member at the back of the chamber to block communication between the chamber and the spectrometer, and, in the chamber, means for cleaning a sample surface exposed to the interior of the chamber, means for extracting debris from the interior of the chamber and means for feeding a purging medium into the chamber.

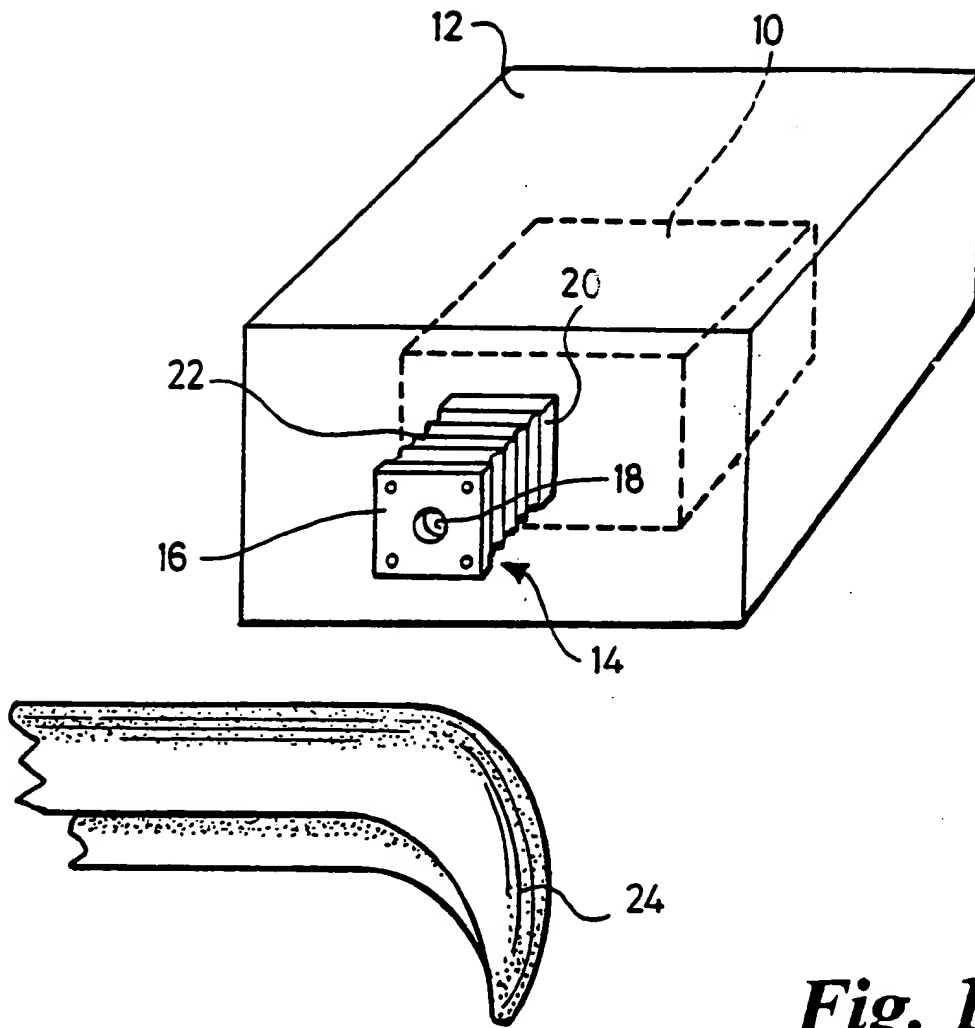
Particular utility is in recycling of plastic materials e.g. vehicle bumpers (24) resulting from scrapping of vehicles. System enables plastics to be sorted according to plastic type.



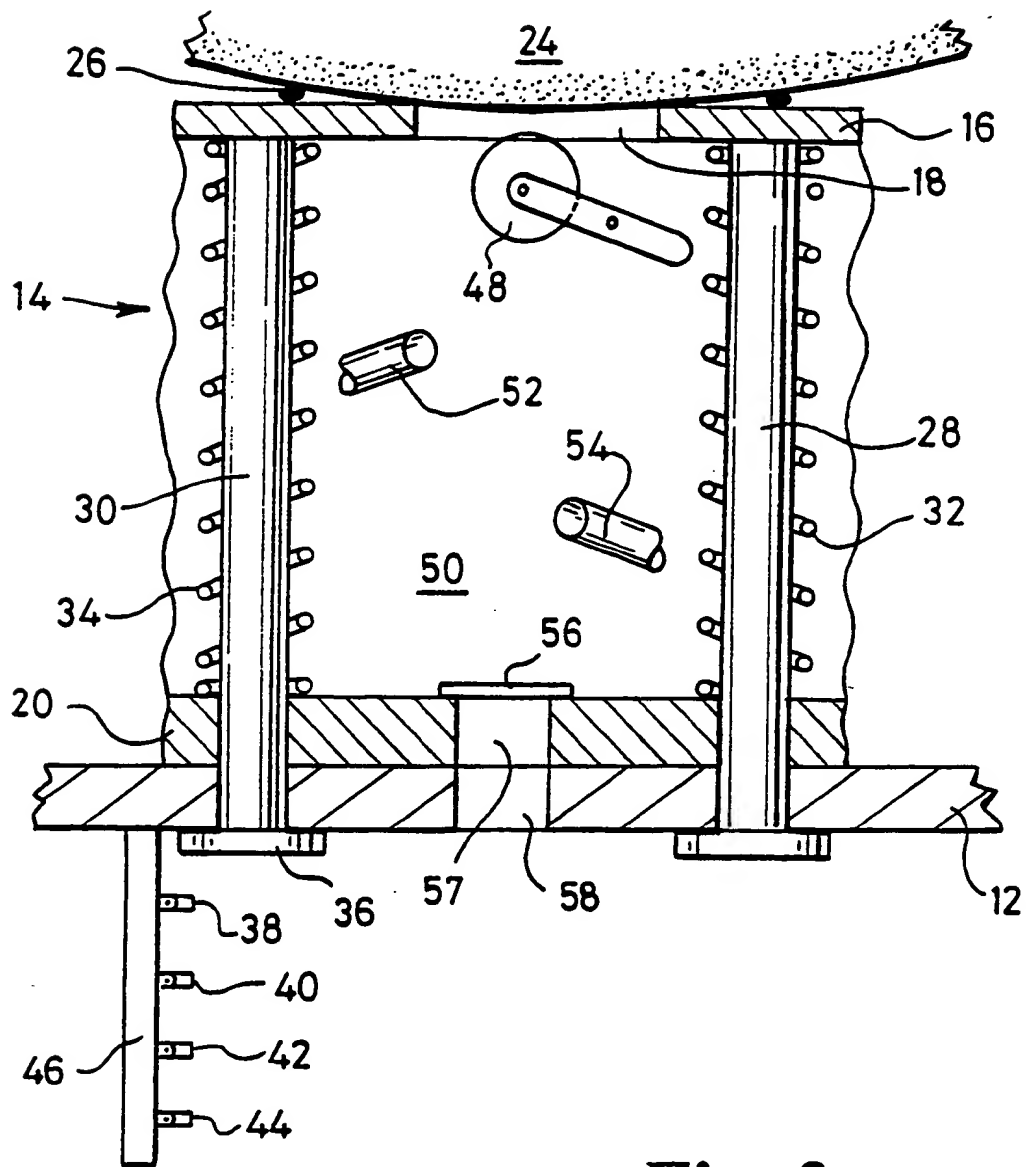
**Fig. 1**

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***Fig. 1***



**Fig. 2**

## PLASTICS IDENTIFICATION

This invention relates to an apparatus for identifying different plastics materials. The apparatus is particularly (but not exclusively) suitable for use in the plastics industry, for separating plastics components into chemically similar groups as a first stage in, for instance, the recycling of the plastics materials.

One field of application is the recycling of motor car components. When a motor car is scrapped, its saleable components such as battery, tyres or radio are removed, usually for use in other vehicles. The metal parts of the scrap car are generally re-cycled, and what remains is shredded and used as land-fill.

The remainder that is used for land-fill consists primarily of a mixture of plastics materials. For environmental and/or economic reasons, it is desirable to be able to recycle such waste plastics materials. However it is not possible effectively to recycle mixtures of waste plastics without first separating the plastics into chemically similar groups or families. Failure to achieve this separation would mean that unknown portions of different plastics were incorporated in the melt during the reclaim process. The presence of other plastics components in a blend may necessitate changes in processing conditions or lead to unacceptable changes in the physical properties of the finished recycled material.

Whilst a number of laboratory techniques are known for identifying different plastics materials, none of these are suitable for use in a continuously operating plastics recycling line, and none of them can cope easily with scrap motor car parts which are of irregular size and

shape and are usually dirty.

Our co-pending International Patent Application number PCT GB93/02244 describes a method and an instrument for identifying plastics materials using a spectroscopy technique. While spectroscopy can lead to accurate results in terms of plastics identification, the instrumentation required is delicate and has to be carefully set up and maintained.

The present invention therefore seeks to provide an interface between spectroscopy apparatus and a piece of plastics to be identified, which will allow plastics components of a wide variety of shapes and conditions to be brought into a uniform position where they can be tested by the apparatus.

According to the present invention, there is provided apparatus for identifying plastics, the apparatus comprising a spectrometer, a protective casing surrounding the spectrometer with a sensing window formed in one face of the casing, and an interface device associated with the aperture, the interface device comprising a chamber having a front wall with a sample aperture against which the sample can be placed so that a surface of the sample is exposed to the interior of the chamber, an operable closure member at the back of the chamber to block communication between the chamber and the spectrometer, and, in the chamber, means for cleaning a sample surface exposed to the interior of the chamber, means for extracting debris from the interior of the chamber and means for feeding a purging medium into the chamber.

The chamber is preferably enclosed by side walls in the form of collapsible bellows. The front wall may be

displaceable towards and away from the sensing aperture of the spectrometer casing, and the displacement may be accomplished by mounting the front wall on spring-loaded guide rods which allow the front wall to be moved towards the sensing aperture, up to a defined end position at which a spectrometer reading will be taken.

The sample surface cleaning means, the debris extraction means and the purging medium feed means may all be sequentially operated by switches which are tripped in turn as the front wall is displaced towards the sensing aperture of the spectrometer casing. The mechanisms for sample surface cleaning, for debris extraction and for introduction of purging medium may all be constructed in such a way that they are brought into position between the front wall and the sensing aperture, when they are operated, and are automatically moved out of the region between the front wall and the sensing aperture when their function has been completed.

The sample surface cleaning means may be a grinding wheel, router or similar device which rotates in contact with the sample surface through the sample aperture of the front wall.

The debris extraction means can be a suction pipe which uses suction to extract debris, particularly debris produced by the action of the sample surface cleaning. The debris extraction means may operate simultaneously with the sample surface cleaning means.

The purging medium feed means will preferably fill the chamber with an inert medium at a positive pressure, prior to the spectrometer reading being taken. The use of a positive pressure will prevent ingress of particles into

the chamber.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a plastics identification apparatus according to the invention, and also showing a plastics item to be identified; and

Figure 2 is a cross-section through part of the apparatus of Figure 1.

Figure 1 shows a spectrometer 10 indicated in dotted lines which is housed within a protective housing 12. The protective housing protects the delicate spectrometer instrument from dirt and other foreign matter and from physical shocks. The housing is therefore continuous around the spectrometer instrument, apart from a sensing aperture or window 58 through which the spectrometer can look at a sample to be analysed.

On one face of the casing 12 there is a sample interface device 14. This device consists of a front plate 16 with a sample aperture 18, a back wall 20 mounted on the outer surface of the housing 12 and a flexible bellows 22 which encloses a chamber between the front wall 16 and the back wall 20. The back wall has an opening 57 which is closed by a shutter 56, and which registers with the sensing window 58 of the housing 12.

A sample to be identified, in this case a motor vehicle bumper 24, is placed against the sample window 18, as will now be described with reference to Figure 2.

In Figure 2 the vehicle bumper 24 (which has a curved rather than a flat surface) is placed against the front wall 16 so that it covers the sample aperture 18. It may be desirable to place a compressible rubber seal 26 around the aperture 18 so that part of the bumper 24 within the seal is sealed against the outside environment.

To take a reading, the operator holds the bumper 24 against the front wall 16 and exerts pressure on the bumper which gradually pushes the bumper and the front wall towards the protective housing 12. The front wall is mounted on guide rods 28, 30 which are biased away from the housing 12 by compression springs 32, 34. The force of these springs can however be overcome by the pressure which the operator exerts on the bumper.

As the inner ends of the guide rods 28, 30 pass into the interior of the casing 12, a foot 36 on the rod 30 moves past switch levers 38, 40, 42, 44 on a switch mounting arm 46. After the first stage of inward movement, the switch lever 38 is tripped and this triggers operation of a grinding wheel 48 which rotates to grind a clean surface area on the bumper. the purpose of this grinding step is to remove any surface treatments such as paint and/or surface grime which may have accumulated on the surface.

As the movement of the front wall 16 towards the housing continues, the foot 36 will next operate the switch lever 40 which will stop operation of the surface cleaning, will cause the grinding wheel to be moved away from the sample aperture, and will start a debris extraction routine which extracts any debris contained within the chamber 50 through a suction pipe 52.

When the foot 36 reaches the third switch lever 42, debris



extraction will stop, the pipe 52 will be moved away from the sample aperture, and the chamber 50 will be purged by introducing an inert gas through a gas pipe 54.

5 Finally when the foot 36 reaches the last switch lever 44, purging will stop, the pipe 54 will be withdrawn, a shutter 56 which closes a sensing window 58 will be opened, and the spectrometer itself will be activated to take a reading of the clean bumper surface 24.

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Once the reading has been taken, a signal is given to the operator, possibly by the illumination of a green light somewhere on the casing, that the bumper can be removed and the springs 32, 34 will then restore the front wall  
15 16 to its original position and the apparatus will be ready for another sample to be put in place and another reading to be taken.

Although a spectrometer can produce very accurate results  
20 in respect of plastics identification, a spectrometer instrument is a delicate instrument, the setting and handling of which requires considerable skill. Using an interface as described here between the spectrometer and the sample to be identified allows the spectrometer to be  
25 isolated from the environment and yet to be used for taking quick readings of a number of different samples.

Claims

1. Apparatus for identifying plastics, the apparatus comprising a spectrometer, a protective casing surrounding the spectrometer with a sensing window formed in one face of the casing, and an interface device associated with the aperture, the interface device comprising a chamber having a front wall with a sample aperture against which the sample can be placed so that a surface of the sample is exposed to the interior of the chamber, an operable closure member at the back of the chamber to block communication between the chamber and the spectrometer, and, in the chamber, means for cleaning a sample surface exposed to the interior of the chamber, means for extracting debris from the interior of the chamber and means for feeding a purging medium into the chamber.

2. Apparatus as claimed in Claim 1, wherein the chamber is enclosed by side walls in the form of collapsible bellows.

3. Apparatus as claimed in Claim 1 or Claim 2, wherein the front wall is displaceable towards and away from the sensing aperture of the spectrometer casing.

4. Apparatus as claimed in Claim 3, wherein the displacement is accomplished by mounting the front wall on spring-loaded guide rods which allow the front wall to be moved towards the sensing aperture, up to a defined end position at which a spectrometer reading will be taken.

5. Apparatus as claimed in any preceding claim, wherein the sample surface cleaning means, the debris extraction means and the purging medium feed means are all adapted to be sequentially operated by switches which are tripped

in turn as the front wall is displaced towards the sensing aperture of the spectrometer casing.

5        6.    Apparatus as claimed in any preceding claim, wherein  
the mechanisms for sample surface cleaning, for debris  
extraction and for introduction of purging medium are all  
constructed in such a way that they are brought into  
position between the front wall and the sensing aperture,  
when they are operated, and are automatically moved out  
10    of the region between the front wall and the sensing  
aperture when their function has been completed.

15       7.    Apparatus as claimed in any preceding claim, wherein  
the sample surface cleaning means is a grinding wheel  
which rotates in contact with the sample surface through  
the sample aperture of the front wall.

20       8.    Apparatus as claimed in any preceding claim, wherein  
the debris extraction means is a suction pipe which uses  
suction to extract debris, particularly debris produced  
by the action of the sample surface cleaning.

25       9.    Apparatus as claimed in any preceding claim, wherein  
the debris extraction means is adapted to operate  
simultaneously with the sample surface cleaning means.

30       10.   Apparatus as claimed in any preceding claim, wherein  
the purging medium feed means is adapted to fill the  
chamber with an inert medium at a positive pressure, prior  
to the spectrometer reading being taken.

11.    Apparatus for identifying plastics, substantially as  
herein described with reference to the accompanying  
drawings.

**Relevant Technical Fields**

(i) UK Cl (Ed.L) G1B (BAA, BCH, BCX)

(ii) Int Cl (Ed.5) G01N 1/34, G01N 21/84, B29B 17/00

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI, CLAIMS, JAPIO

Search Examiner  
M R WENDT

Date of completion of Search  
20 JUNE 1994

Documents considered relevant  
following a search in respect of  
Claims :-  
1-11

**Categories of documents**

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|---|---|
| <b>X:</b> Document indicating lack of novelty or of inventive step.   | <b>P:</b> Document published on or after the declared priority date but before the filing date of the present application.        |
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| <b>A:</b> Document indicating technological background and/or state of the art.   | <b>&amp;:</b> Member of the same patent family; corresponding document.   |

Category	Identity of document and relevant passages	Relevant to claim(s)
	None	